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HEALTH PHYSICS CONSIDERATIONS FOR THE DISPOSAL OF
NON-ENRICHED URANIUM CHIPS BY BURNING

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Waste, salvage, by-products - these are familiar terms of a modern-day industry. Materials in this category have no doubt created many sizable problems for a production facility; however, when the material is a radioactive substance, the problem is more complex and does not follow routine disposal procedures. Recently, this industry was confronted by this type of problem. The material to be disposed of was low-level, non-enriched uranium chips and turnings generated from machining type operations. The material being radioactive, pyrophoric, bulky, accountable - yet low in economic value, and not suited for returns to production normal cycle, presented a considerable disposal and storage problem.

Being confronted by these facts, several ideas were extended for the disposal and storage of this material. Let us now discuss the ideas which were proposed.

Case 1, for example, was to press uranium chips into briquettes and recast the briquettes into uranium metal. After material was cast, it would require covered-type storage. Of course this avenue was one solution to

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the problem, since in the metal state the material has non-pyrophoric characteristics. This idea for the disposal of a non-useful, accountable material was not pursued to a great extent due to economics.

The second idea, which we shall call Case 2, was to dump the chips into one large pit in chip form and cover with soil. This idea seems logical when considering economics, however, certain shortcomings would be incurred, such as the possibility of having an uncontrollable fire from the pyrophoric material during the filling operation. If the chips did not catch fire by spontaneous combustion, during the filling phase, the pit was to be covered. This again presented certain problems, since this material in contact with water liberates hydrogen. Hydrogen, being explosive, could only add to hazards involved. This method was discounted due to the dangers in handling and storage; also the recovery of the material, at some future date, would be extremely hazardous.

The third case which was considered was to transfer the chips to a small pit area and dispose by reducing the material to an oxide state by burning; however, at this time, it was not really known what air-borne or health problems would be involved by controlled burning. This idea presented several good points:

1. A pyrophoric material by this technique would be reduced to a non-pyrophoric state.

2. The size of area required to store the material in an oxide state would be relatively small as that compared to Case 2.
3. The material would be not only in a stable state, but would be easy to recover for future use. However, the one question unanswered at this time was the health and safety problems associated with burning uranium metal.

Since the third case presented several advantages as compared to Cases 1 and 2, tests were planned which would actually define what amount of material could be disposed of at any single time by this technique.

The test site selected was an isolated area some 1 1/4 miles from the nearest occupied area. After the test site area was prepared, uranium turnings and chips were loaded directly from the machining operations to standard dumpsters for quick and efficient transfer of material to the test area. The dumpsters were partially filled with water prior to loading. The water served as a shock medium and fire suppressor during the transfer operation. This technique for handling uranium chips was found to be acceptable after experiencing one spontaneous chip fire in a dumpster prior to transfer to the test site. This type of procedure was followed for 13 tests. The amount of material disposed of at each test was varied.

During each test, standard high volume air monitoring equipment was used to define the air-borne problems associated with the burning of this material. These instruments were strategically located at varying distances on the downwind and upwind sides of each operation. The tests were also conducted in varying atmospheric conditions. Table I summarizes five of the tests that were conducted with varying amounts of material. In addition to the air monitors located in the immediate test site area, eleven downwind air monitors were used. These monitors ranged approximately 1 1/4 to 3 miles downwind. The results of the downwind air monitors were compared under similar atmospheric conditions during burning operations, as compared to results of the air concentrations when no burning operations were being performed. Figure I shows a graph of these results over a three-month period during similar atmospheric conditions as supplied by the United States Weather Bureau for the test site geographical area. The results as shown in Table I are for the most part of a low order of magnitude. It should be noted that on the downwind side, as expected, the air-borne concentrations are much higher, however, these values do not present any problem from a health standpoint in a controlled area. The downwind samples, Figure I, do not seem to reveal any significant difference in air-borne concentration at increased distance from the test site during burning operations as compared to non-burning operations.

It is interesting to note that the material during all tests, as shown in Figure II, burns relatively clean with little visible smoke. This can be

attributed to the cleanliness of the chips and the water soluble coolant used during the machining operations.

In conclusion, the disposal of non-enriched uranium chips by controlled burning, in an isolated area, would be an acceptable practice and well within the limits as stipulated by the International Committee on Radiation Protection.

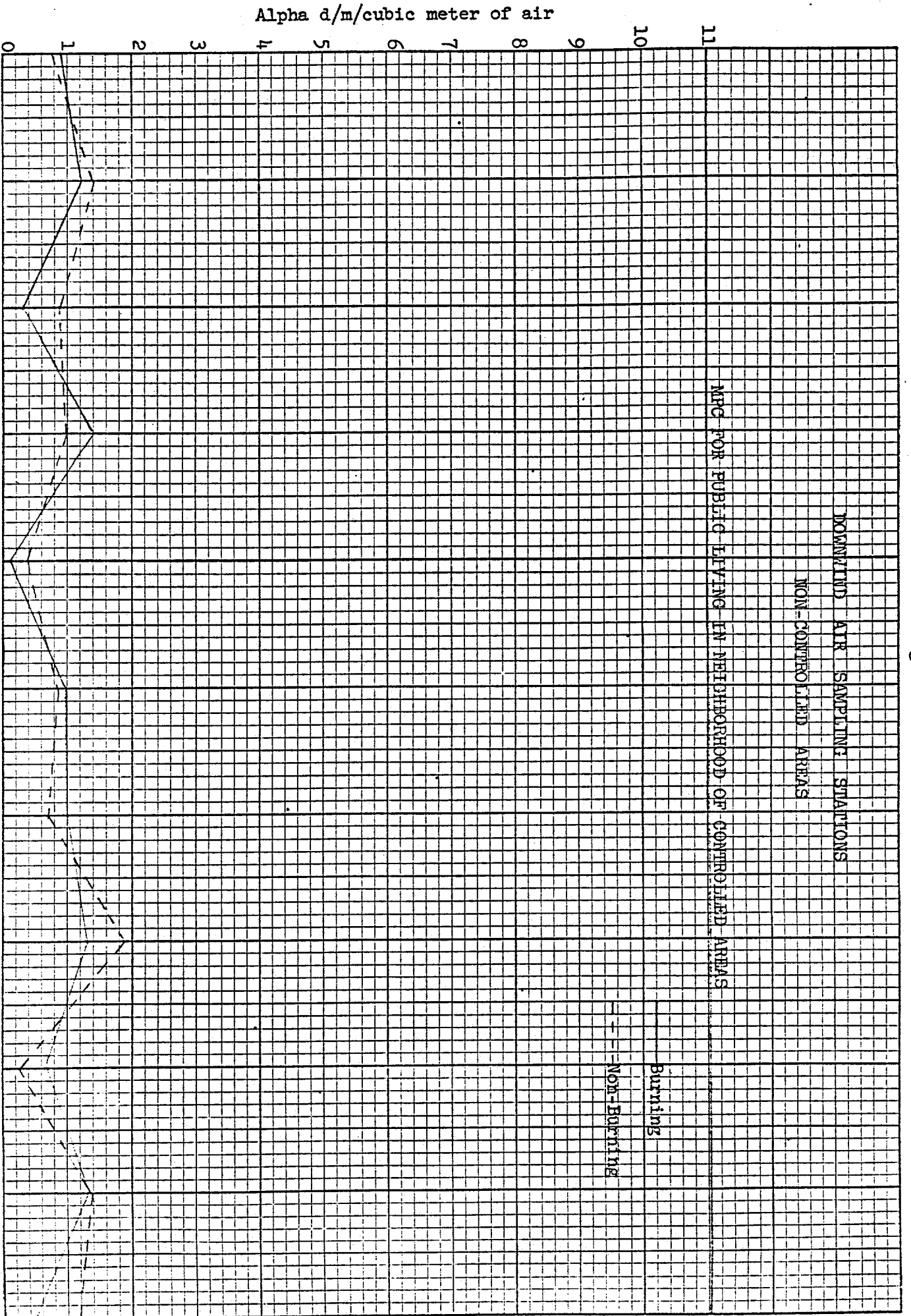
Table I

TEST SITE

AIR SAMPLE DATA

Alpha d/m/M3										Wind
12 ft. of Pit				40 ft. of Pit				100 ft. of Pit		Direction
North	East	South	West	West	North	North	East	South	West	From
16.9	100.8	2.0	1.7	5.6	11.3	1.6	2.7	1.0	1.4	West
11.4	1.2	2.9	201.1	2.2	17.5	3.6	1.6	2.8	3.8	Southeast
3.4	81.3	1.3	1.9	3.3	2.6	1.1	3.0	1.2	2.0	West
36.4	48.8	6.2	4.8	37.3	38.6	4.8	13.6	2.0	1.7	Variable South- west
10.5	98.7	1.8	2.0	3.2	11.2	1.5	2.1	1.0	1.2	West

Figure I



3-Month Period

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MADE IN U.S.A.

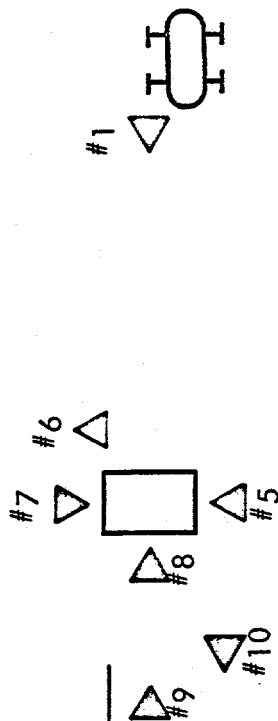
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Figure II
URANIUM CHIP FIRE

SAMPLER DISTANCE FROM PIT	
SAMPLER NO.	DISTANCE, FEET
1	100
2	100
3	100
4	100
5	15
6	12
7	12
8	15
9	40
10	40



△ - AIR SAMPLERS

TEST SITE AREA